# Observed Decadal Variations of the Tropical Mean Radiative Energy and Iris Estimations

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# Outline

1. Background

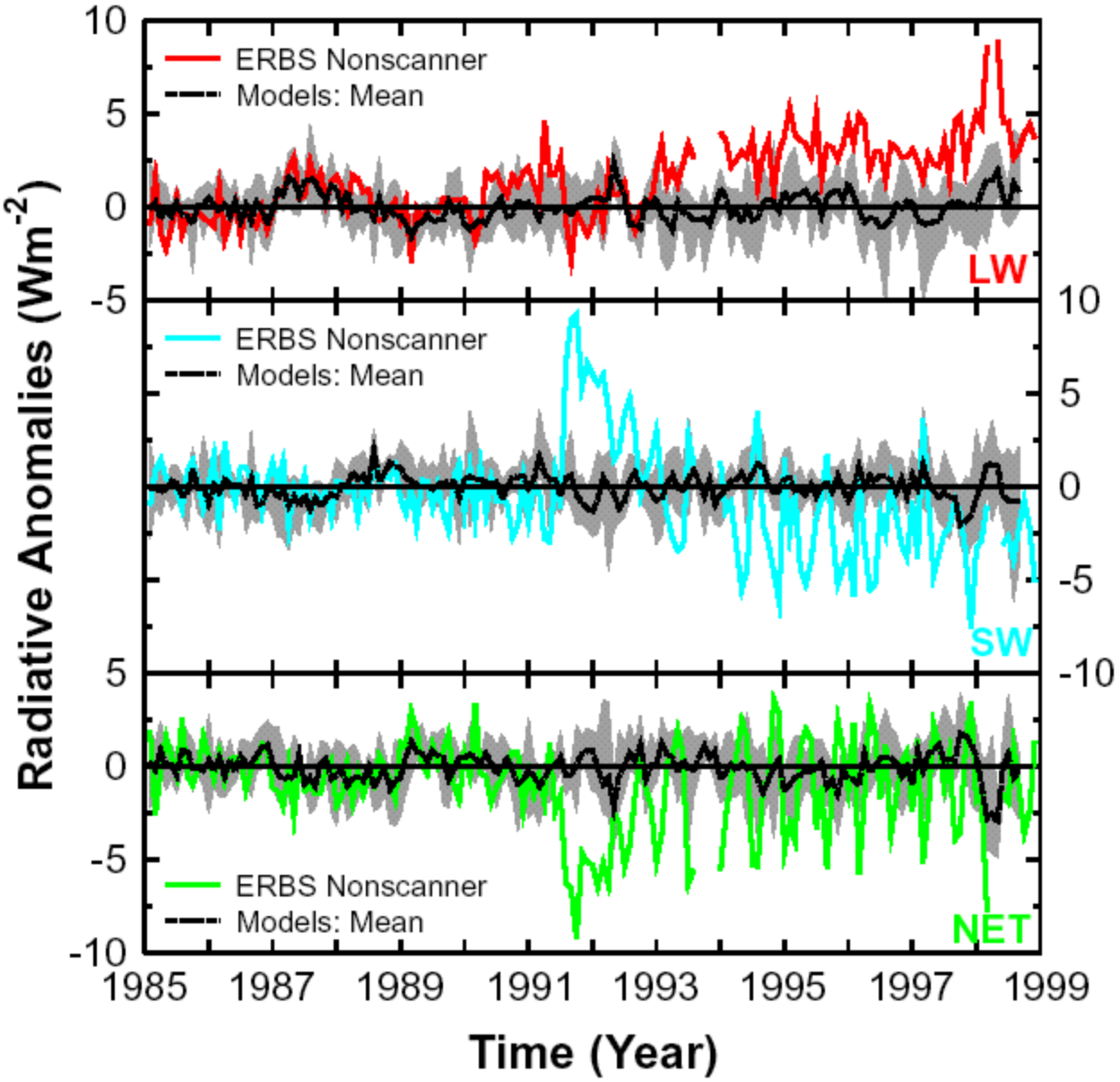
   tropical cloud variations

2. ERBE/CERES Data & Model Results

3. Anomalies estimated from Iris and LaRC assumptions

4. Summary

# Wielicki et al. 2002



# tropical cloud change

Fig. 2
±30° lat

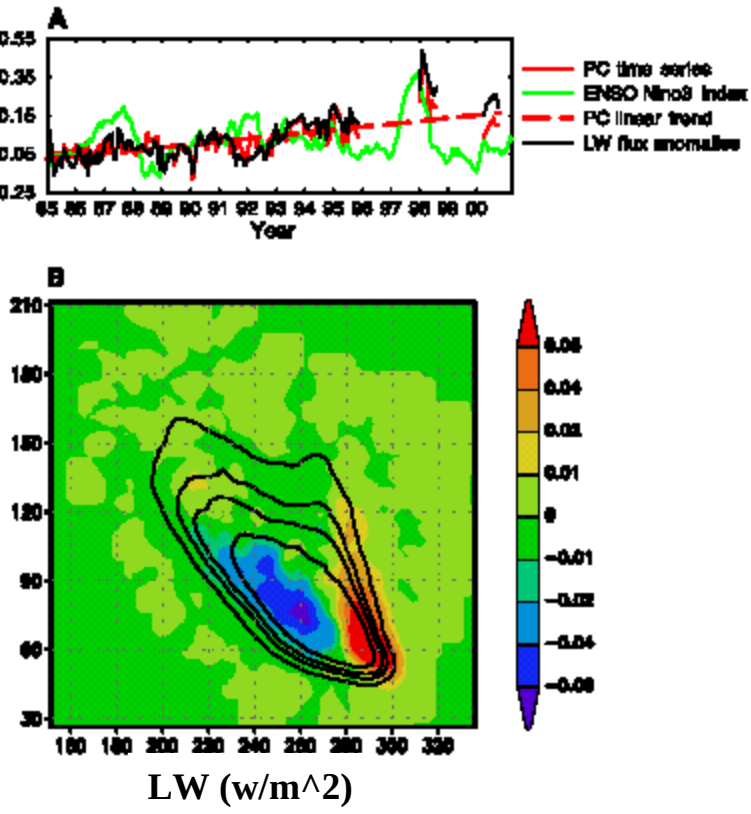
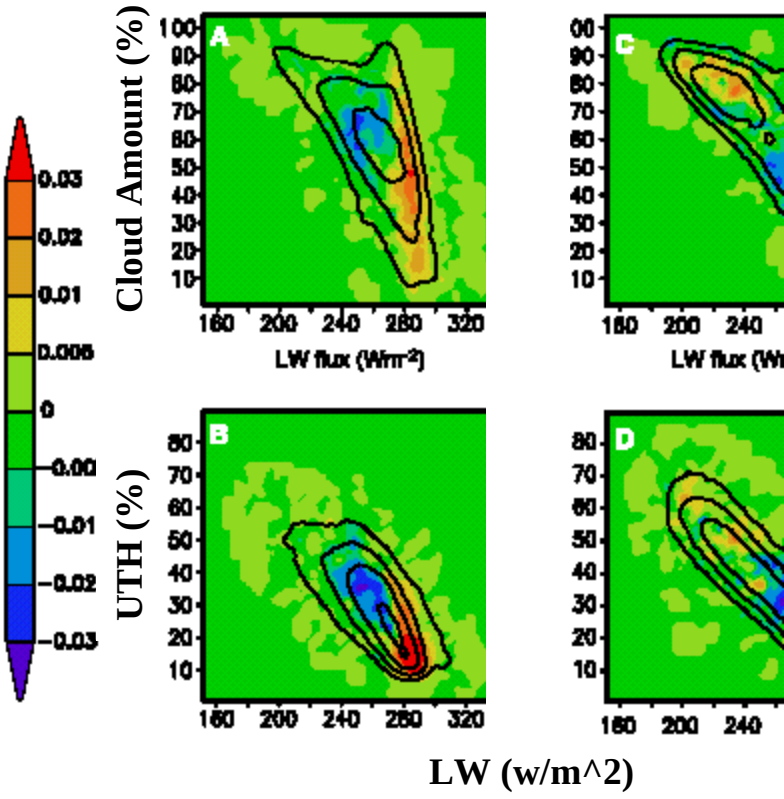



Fig. 4
subtrop. equator




## Chen et al. 2002

Wielicki et al. (2002): decadal radiative fluxes anomalies – decreasing clouds

Chen et al. (2002): tropical cloud variations

GCM & reanalysis results don't have the large tropical radiation changes (tropical surprise)

Reporters for Lindzen/Ellsaesser theories:

'deep convection' vindicated (Zoraster, 2002)

Iris effects (2001); deep convection (1984)

# 2. Data Sets

- ERBS nonscanner LW, SW and Net anomalies (±20°N; 1985 ~ 1998)
- CERES TRMM (01 ~ 08, 1998)

- NCEP reanalysis + 5 GCMs
- NCEP sea surface temperature

**Monthly and 72-day cycle**

**Tropical Means**

# 3. Radiative Anomaly Estimations

Radiative fluxes:

Iris hypothesis & LaRC CERES Obs.

1st normal condition, then climate variations

Cloud (or cloudy moist area coverage) variations with SST as suggested by Lindzen et al.

changes in area coverages of clear moist and dry regions

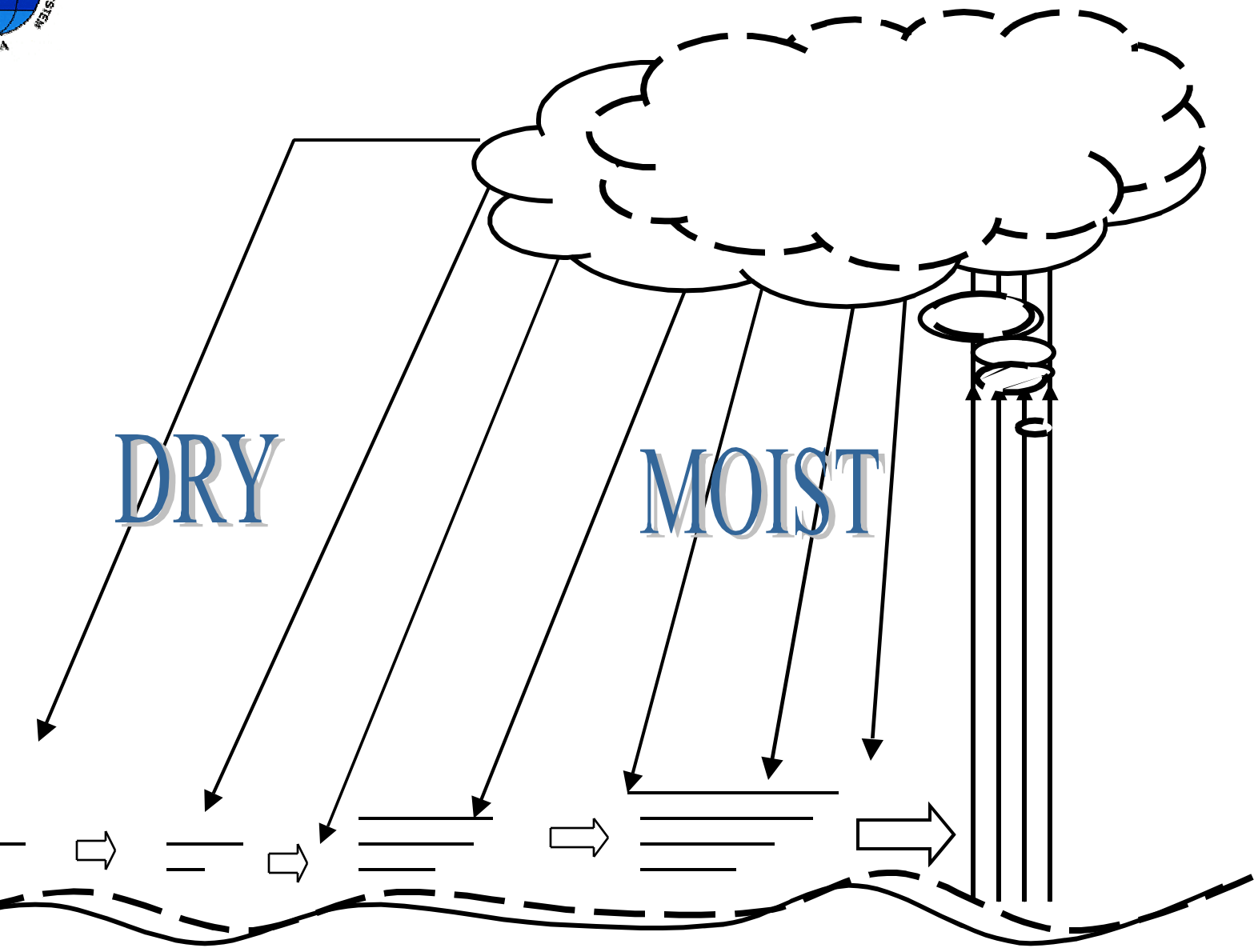
Calculation: 3.5 box model

ΔSST, radiative anomalies

# radiative fluxes (Lin et al. 2002)

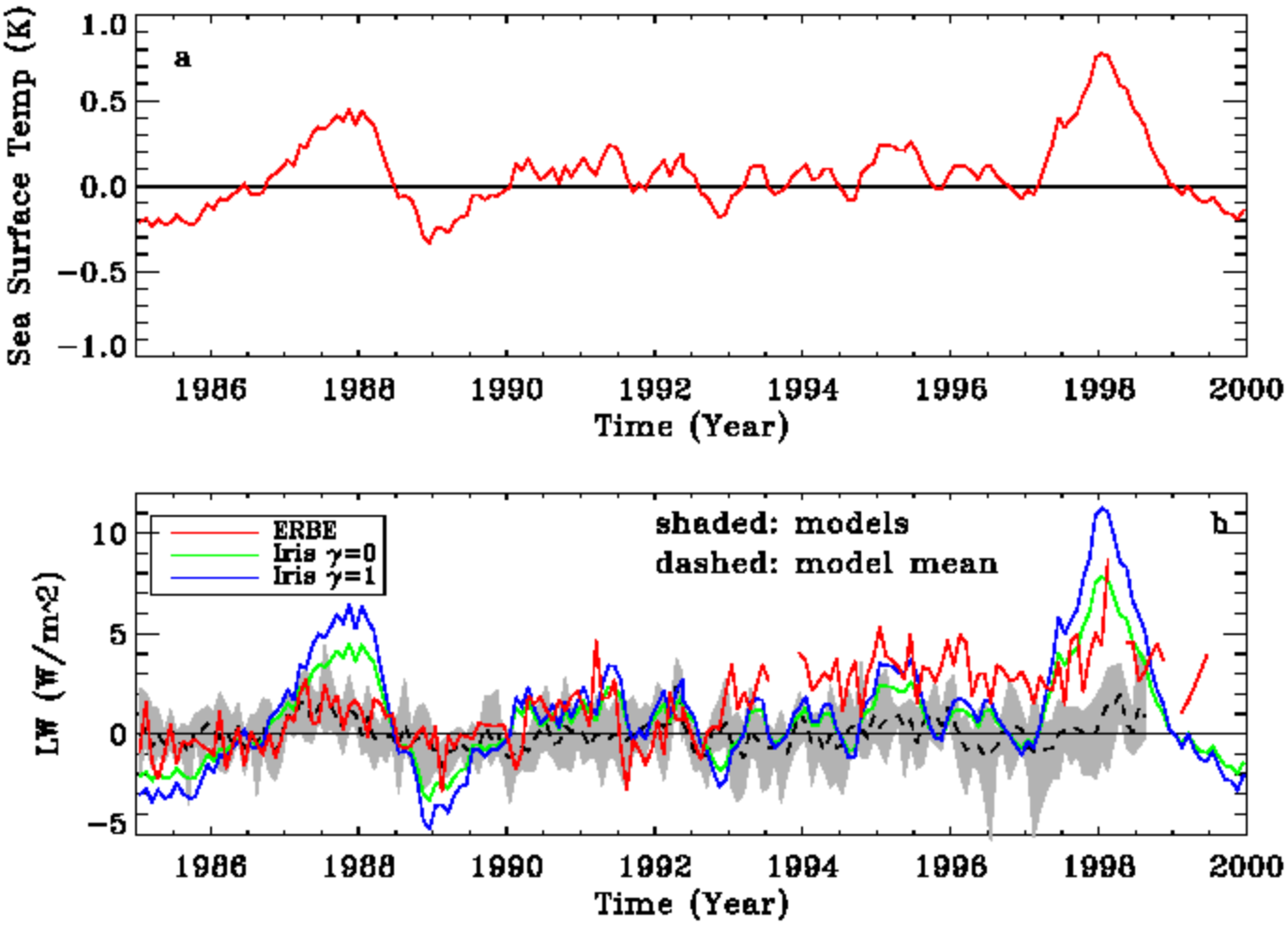
| | LaRC ¾ CERES | | | Lindzen et al. | | |
|---|---|---|---|---|---|---|
| | dry | clear moist | cloudy moist | dry | clear moist | cloud moist |
| eq | 0.5 | 0.4 | 0.1 | 0.5 | 0.28 | 0.22 |
| lbed | 0.154 | 0.258 | 0.510 | 0.211 | 0.211 | 0.349 |
| W↓ | 338.7 | 297.1 | 196.2 | 315.9 | 315.9 | 260.6 |
| W↑ | 287.7 | 253.9 | 154.8 | 303.1 | 263.1 | 137.7 |

# cloud variations

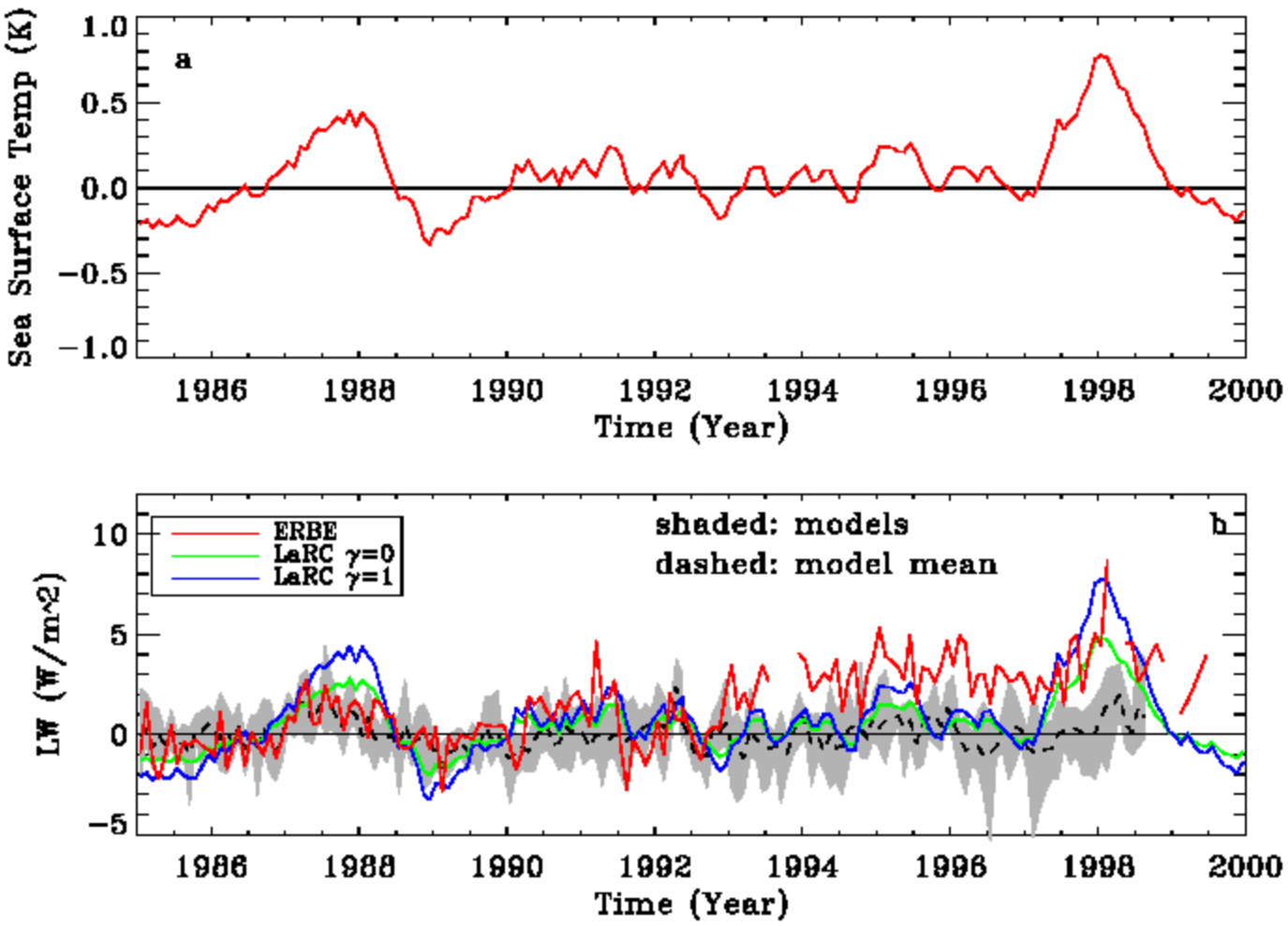



## SST variations

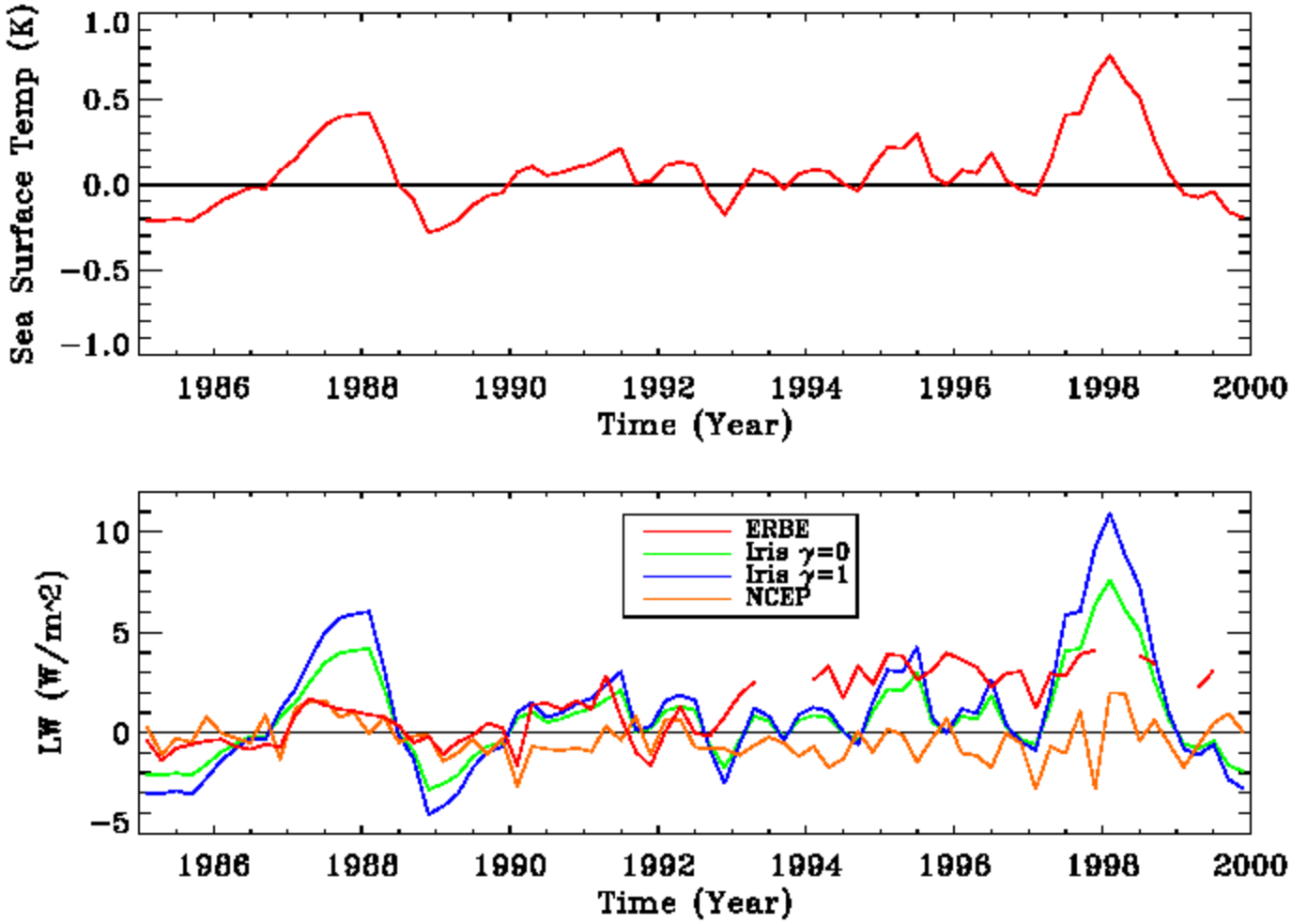
# LW calculation using Iris



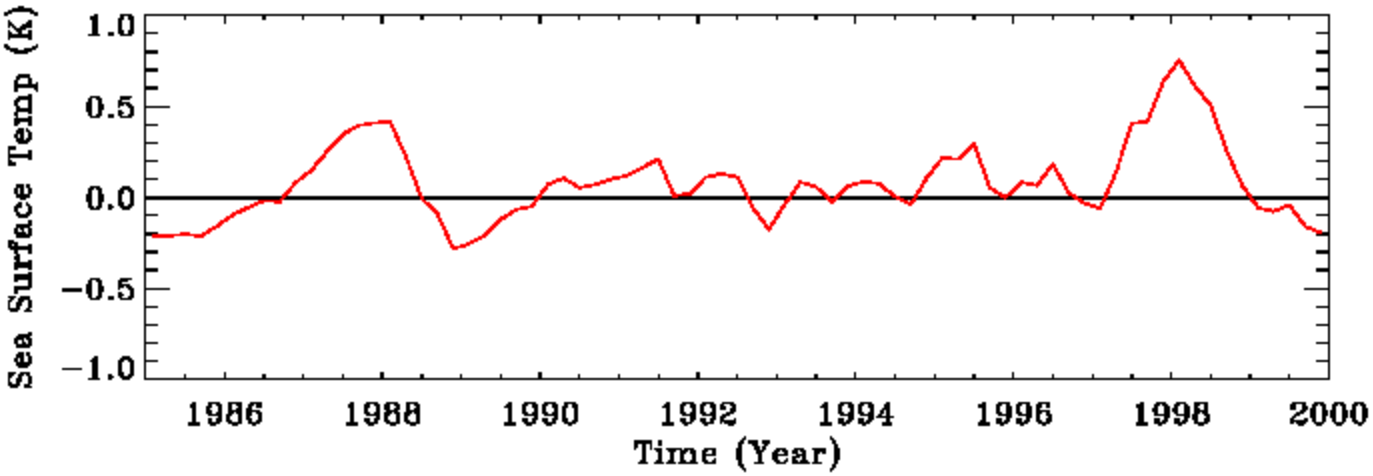
# LW calculation using LaRC

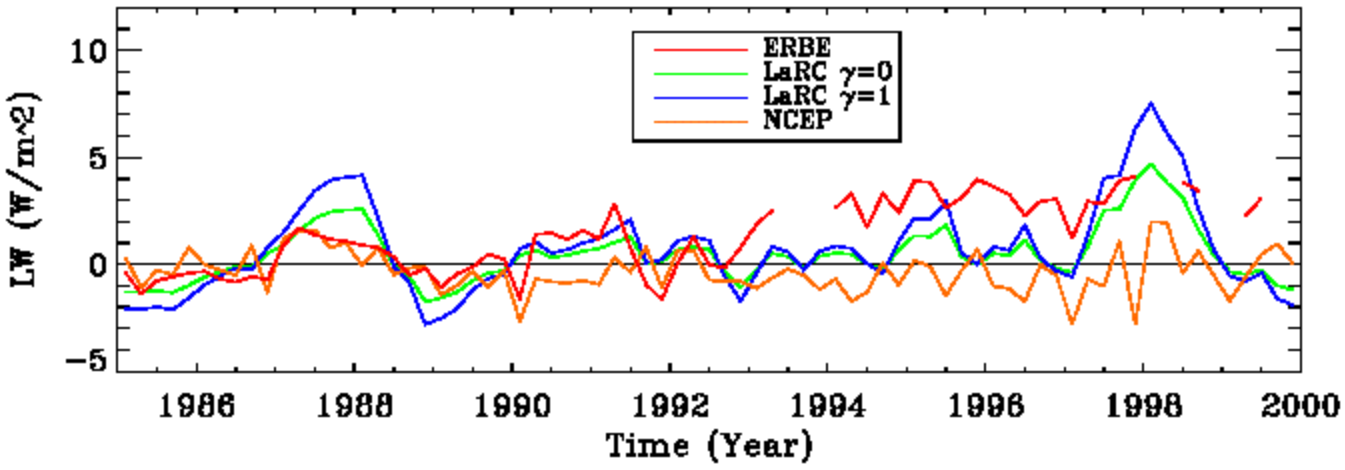


# Iris LW (72-day cycle)

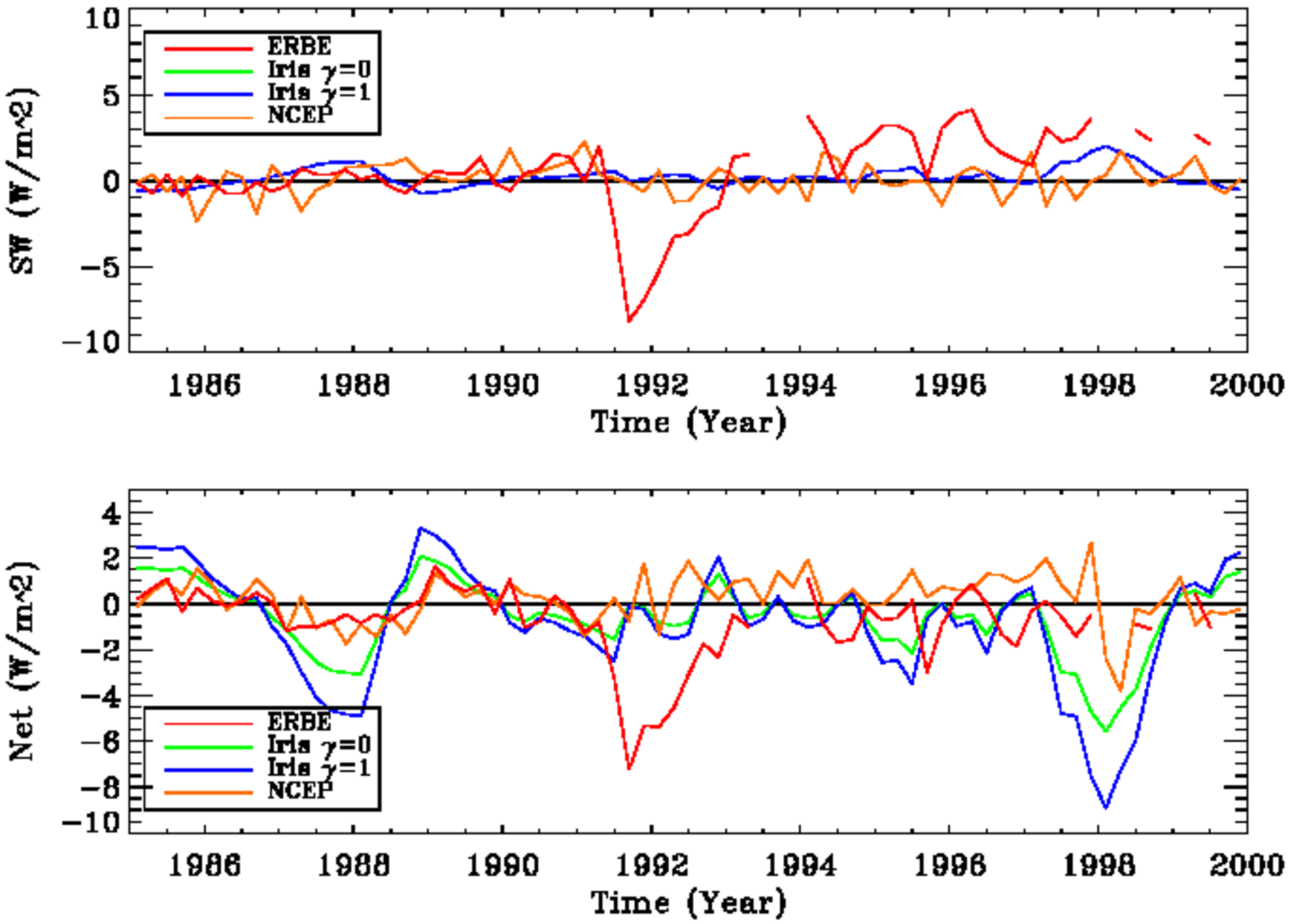


# LaRC LW (72-day cycle)

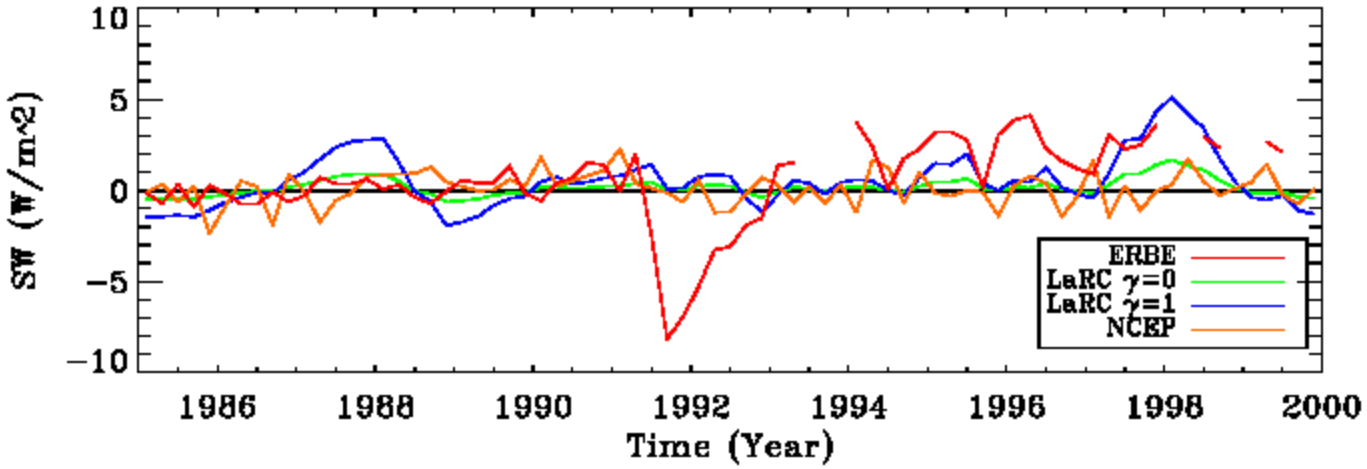


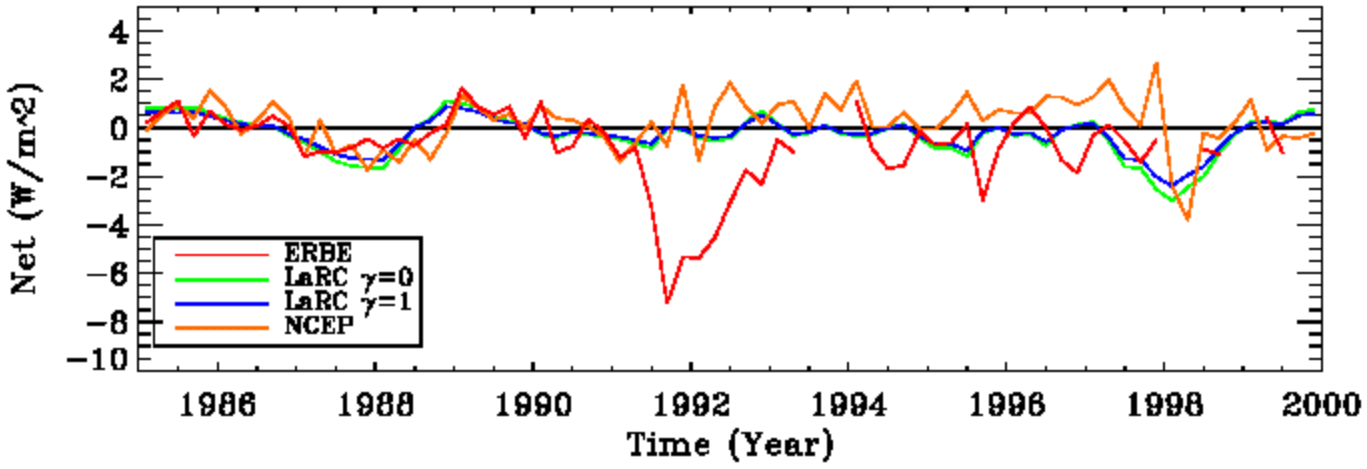



# Iris SW & Net (72-day cycle)



# LaRC SW & Net (72-day cycle)



# 72-day cycle statistics

## data without Pinatubo

| | corr. | random length | conf. | autocorrelation indep. | conf |
|---|---|---|---|---|---|
| V | 0.563 | 58 | 1.0 | 22.6 | .996 |
| | 0.379 | 58 | 0.997 | 35.14 | .98 |
| | 0.401 | 58 | 0.998 | 30.6 | |

# decadal forcings (72-day cycle)

## 72-day cycle data without Pinatubo

averaged observational and estimated forcing

(94~97 verse 85~89; ΔSST = 0.144K)

| ERBE | Iris γ=0 | γ = 1 | LaRC γ = 0 | γ = 1 |
|---|---|---|---|---|
| 3.051 | 1.434 | 2.066 | | 0.887 |
| | 1.424 | | | |
| 2.4 | 0.382 | 0.382 | 0.319 | |
| 0.976 | | | | |
| -0.651 | -1.052 | -1.684 | | -0.56 |

# 4. Summary

ropical convection: enhanced during 90's vs 80's.

ΔSST: increased (0.144K).

adiative/SST anomalies: correlated well (↔) with ERBE

GCMs ?)

NSO time scale, Iris LW anomalies ↔ ERBE data

ometimes even quantitatively.

LaRC LW, SW, and Net anomalies — **equally good or even bet**

uantitatively, Iris and LaRC anomaly estimates **don't have** big
nough decadal variations as suggested by ERBE NS data.

here is **no indication** in the ERBE/CERES observed decadal da
hat tropical cloud systems would produce strong negative feedba
o stabilize climate system, as suggested by Iris hypothesis.

# Acknowledgement


- David Young, Bob Lee, and G.L Smith gave many suggestions and comments on data processing and this research.

- LaRC DAAC for ERBE and CERES data sets.

- NCEP-NCAR model and reanalysis data.